Table 1: Summary of Data and Potential Exposure Scenarios				
Area Name	**Data Results[1]**	**Description**	**Potential Impacts/Exposure Scenarios**	**Data Source(s)**
Lorraine Waste	Lead 513 mg/kg; waste is visually similar to and is consistent with the tar oil-like sludge found at other historic tank locations	Visual	Sand Creek (direct discharge/migration to surface water/sediment); Eco and Human Health receptors (direct exposure)	Phase 2-Mobilization 1 Field Events 1, 2, and 3, 2016 Lorraine Refinery SI, 2009
Lead Sweetening Area	Lead >75,000 mg/kg <u>Perched Water:</u> 2-methylphenol $1.5x10^6$ µg/l Phenol 270,000 µg/l 2,4 dimethylphenol $1.3x10^6$ µg/l Lead >752 µg/l Benzene 2400 µg/l	ERT XRF assumed	Sand Creek (migration and discharge to surface water/sediment); Eco and Human Health receptors (direct exposure)	Phase 2-Mobilization 1 Field Events 1, 2, and 3, 2016 ERT, 2016 ESI Wilcox Oil, 1997
Tank 1	None; waste is visually similar to and is consistent with the tar oil-like sludge found at other historic tank locations	Visual	Sand Creek (direct discharge/migration to surface water/sediment); Eco and Human Health receptors (direct exposure)	Phase 2-Mobilization 1 Field Events 1, 2, and 3, 2016
Tank 3	TPH 85,700 mg/kg TPH 23,200 mg/kg	Visual, direct push, passive gas	Sand Creek (direct discharge/migration to surface water/sediment); Eco and Human Health receptors (direct exposure)	Phase 2-Mobilization 1 Field Events 1, 2, and 3, 2016 ESI Wilcox Oil, 1997
Tank 5	Benzo(a)anthracene 11000 µg/kg Benzo(a)pyrene 12000 µg/kg Benzo(b)fluoranthene 20000 µg/kg Benzo(k)fluoranthene 7500 µg/kg Chrysene 13000 µg/kg Fluoranthene 6100 µg/kg Indeno(1,2,3-cd)pyrene 3100 µg/kg Pyrene 6900 µg/kg	Visual, direct push, passive gas.	Eco and Human Health receptors (direct exposure and indoor air)	Phase 2-Mobilization 1 Field Events 1, 2, and 3, 2016 Removal Assessment, 2016 ERT, 2016
Tank 10	Lead 3660 mg/kg 2-methylnaphthalene 1.4×10^6 µg/kg Benzo(a)antracene 1800 µg/kg	Visual and LIF;	Eco and Human Health receptors (direct exposure)	Phase 2-Mobilization 1 Field Events 1, 2, and 3, 2016 ESI Wilcox Oil, 1997

Table 1: Summary of Data and Potential Exposure Scenarios

Area Name	Data Results[1]	Description	Potential Impacts/Exposure Scenarios	Data Source(s)
	Pyrene 3300 µg/kg phenanthrene 520,000 µg/kg total xylenes 450 µg/kg TPH 875000 mg/kg			ESI Wilcox/Lorraine 2011
Tank 11	Pyrene 54,000 µg/kg TPH 293,000 mg/kg	Visual	Eco and Human Health receptors (direct exposure)	Phase 2-Mobilization 1 Field Events 1, 2, and 3, 2016 ESI Wilcox Oil, 1997
Tank 12	Lead >800 mg/kg Benzo(a)anthracene 760 µg/kg Benzo(a)pyrene 1200 µg/kg Benzo(b)fluoranthene 2400 µg/kg Fluoranthene 2500 µg/kg pyrene 2100 µg/kg <u>Perched Water:</u> 2-methylphenol 1.5×10^{6} µg/l Phenol 270,000 µg/l 2,4 dimethylphenol 1.3x106 µg/l Lead >752 µg/l Benzene 2400 µg/l	Visual identification, direct push;	Sand Creek (migration and discharge to surface water/sediment); Eco and Human Health receptors (direct exposure)	Phase 2-Mobilization 1 Field Events 1, 2, and 3, 2016 ERT, 2016
Pit 1	TPH 427,000 mg/kg toluene 270 µg/kg xylene 280 µg/kg pyrene 230,000 µg/kg TPH 494,000 mg/kg	Visual Test pit and LIF	Eco and Human Health receptors (direct exposure)	Phase 2-Mobilization 1 Field Events 1, 2, and 3, 2016 Removal Assessment, 2016 ESI Wilcox Oil, 1997

Notes:
1 This column in not all inclusive. This is a limited summary of detected contaminants, specifically listing those with the highest concentrations.

Abbreviations: cy=cubic yards cf=cubic feet ft=feet TPH=total petroleum hydrocarbon sf=square foot
LIF: light induced fluorescence mg/kg=milligram per kilogram µg/kg=microgram per kilogram
ESI=Expanded Site Investigation SI=Site Investigation ERT=Environmental Response Team

Table 2: Passive Soil Gas and Indoor Air/Sub-slab Data

Passive Soil Gas Results	
COMPOUNDS	Result: ng
Benzene	8652
Toluene	2,682
Ethylbenzene	8,453
p & m-Xylene	15,656
o-Xylene	6,326
Naphthalene	2,145
2-Methylnaphthalene	10,027

Results in nanograms (ng).

Indoor Air/Sub-slab	
Analyte	Result: ($\mu g/m^3$)
Chloroform	0.93
1,4-Dichlorobenzene	1.08
Benzene	5.57
Ethylbenzene	1.44
1,3-Butadiene	11.7
Trichlorofluoromethane	43.4
1,2,4-Trimethylbenzene	2.12
Trichloroethene	2.53

Results in micrograms per cubic meter ($\mu g/m^3$)

Table 3: Areas of Remediation – Estimated Volume and Cost		
Area Name	**Volume Estimated (cubic yards)**	**Estimated Cost**
Lorraine Waste	952.22	$107,322
Lead Sweetening Area	6,532.44	$1,814,722
Tank 1	3,322.22	$362,549
Tank 3	6013.71	$643,938
Tank 5	2042.96	$223,780
Tank 10	9,901.78	$1,041,401
Tank 11	430.93	$53,461
Tank 12	4,787.78	$523,755
Pit 1	4,269.07	$463,392
Total	38,253.11 (5.38 Acres)	$5,234,322.00

Source: Remedial Action Cost Engineering and Requirements System, Version 11.2.16.0, software used to estimate cost.
Conversion: 1.4(cy) = tons

Table 4: Comparison of site data to Health Based Screening Levels				
	Contaminant	**Data Results (mg/kg)**	**Health Based Screening Level (mg/kg)**	**Health Based Screening Level Basis**
Lead Sweetening Area	Lead	>75,000	400	Protection of blood lead levels
Waste Material	Benzo(a)anthracene	11	0.16	Residential Cancer Screening Number at 10-6 Risk
	Benzo(a)pyrene	12	0.016	Residential Cancer Screening Number at 10-6 Risk
	Benzo(b)fluoranthene	20	0.16	Residential Cancer Screening Number at 10-6 Risk
	Perched Water (result of migration from waste material)			
		Data Results (µg/kg)	**Health Based Screening number (µg/kg)**	**Health Based Screening Number Basis**
	2-methylphenol	1.5×10^6	930	Residential Non-Cancer Screening Number at Hazard Index=1
	Phenol	270,000	5800	Residential Non-Cancer Screening Number at Hazard Index=1
	2,4 dimethylphenol	1.3×10^6	360	Residential Non-Cancer Screening Number at Hazard Index=1
	Lead	>752	15	Action Level for Drinking Water
	Benzene	2400	5	Maximum Contaminant Level for Drinking Water

Table 6: Remedy Comparison to Nine Criteria			
Remedy	No Action	Excavation and Offsite Disposal with Treatment	Excavation, Treatment, Consolidation, and Capping
Overall Protection of Human Health and the Environment	0	2	1
Compliance with ARARs	0	2	1
Long-term Effectiveness and Permanence	0	2	1
Reductions in Toxicity, Mobility, and Volume through Treatment	0	1	1
Short-term Effectiveness	0	2	2
Implementability	2	2	2
Cost	$0	$5,234,322	$5,447,570
State Acceptance	State Supports the Proposed Early Action		
Community Acceptance	Assessment determined after the review and comment period		
Total Score	2	11	8

Score Definitions

0 does not satisfy the criteria

1 Satisfies the criteria but requires long-term maintenance or partially satisfies

2 Satisfies the criteria

Table 5: Technology Screening

	General Response	Remedial Technology	Process Option	Cost Comparison	Screening Comments
Lead Sweetening Area	Removal	Physical Removal	Excavation	*	permanent removal; unrestricted use; no long-term maintenance or administrative controls; commercially available and demonstrated technology
	Containment	Capping	Clay and Membrane	**	long-term maintenance needed; 5-yr reviews-administrative controls; location will compromise current land use and remaining RI; water infiltration layer for mitigation of leaching; commercially available and demonstrated technology
			Clay and Vegetation	*	long-term maintenance needed; 5-yr reviews-administrative controls; location will compromise current land use and remaining RI; soil/vegetative cover may not restrict water to mitigate leaching; commercially available and demonstrated technology
	Treatment	Physical/Chemical Treatment	Immobilization	*	effective for metals; treatability studies required; commercially available and demonstrated technology;
			Reclamation	**	Small volume of media; high moisture content; not economically viable (i.e., technology costs exceed benefit); presence of sulfur compounds and phenols; specialized vendors and equipment
Waste Material	Removal	Physical Removal	Excavation	*	offsite treatment; permanent removal; unrestricted use; no long-term maintenance or administrative controls;
	Containment	Capping	Clay and Membrane	**	onsite treatment; long-term maintenance needed; 5-yr reviews-administrative controls; location will compromise current land use and remaining RI
			Clay and Vegetation	*	onsite treatment; long-term maintenance needed; 5-yr reviews-administrative controls; location will compromise current land use and remaining RI
	Treatment	Physical/Chemical Treatment	Immobilization	**	partially to non- effective on organics source; necessary to combine with other technologies; treatability studies required; organic compound can prevent immobilization; efficiency limited by high TPH content
		Thermal Treatment	Incineration	***	effective in treating organics; treatability studies required; cost far exceeds risk reduction benefit when compared with other

Table 5: Technology Screening					
	General Response	**Remedial Technology**	**Process Option**	**Cost Comparison**	**Screening Comments**
					technologies; significant materials handling; specialized equipment and vendor;
			Low Thermal Desorption	****	partial treatment of organics; combination with other technology for residuals; treatability studies required; cost far exceeds risk reduction benefit when compared with other technologies; significant materials handling; specialized equipment and vendor;
		Biological Treatment	Land Farming	*	partially effective on high levels of organics; residuals may need management through ICs/O&M, etc; extended time to reach RAOS; would not be effective in treating metals; treatability studies required; implementation will compromise current land use and restrict remaining RI

Notes: TPH = total petroleum hydrocarbon RI = remedial investigation

screened from further evaluation

Resources:

1. Technology Screening Guide for Treatment of CERCLA Soils and Sludges, Office of Solid waste and Emergency Response, EPA/540/2-88/004, September 1988
2. Presumptive remedy for Metals-in-Soil Sites, Office of Solid Waste and Emergency Response, EPA-540-F-98-054, OSWER-93550.0-72FS, September 1999
3. Implementing Presumptive Remedies: A Notebook of Guidance and Resource Materials, Office of Solid Waste and Emergency Response, EPA-540-R-97-029, OSWER 9378.0-11, October 1997
4. Presumptive Remedies for Soils, sediments, and Sludges at Wood Treater Sites, Office of Solid Waste and Emergency Response, EPA 540-R-95-128, OSWER 9200.5-162, December 1995